

**A CRYSTAL PULLER AND METHOD FOR GROWING A
MONOCRYSTALLINE INGOT**

ABSTRACT

[00169] A crystal puller for growing monocrystalline ingots includes a side heater adjacent a crucible for heating the crucible and a melt heat exchanger sized and shaped for surrounding the ingot and disposed adjacent a surface of the melt. The heat exchanger includes a heat source having an area for radiating heat to the melt for controlling heat transfer at the upper surface of the melt. The melt heat exchanger is adapted to reduce heat loss at the exposed upper surface portion. Methods for growing single crystal silicon crystals having desired defect characteristics are disclosed.